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ABSTRACT

A study looks at two broad issues: (1) the relationship between sentence sequence and 'coherence' in writing of academic discourse in a second language; and (2) identification of likely areas of difficulty for second-language readers. Two approaches to the diagnosis of coherence problems, using experimental manipulation of sentence orders in paragraphs or extended text, are discussed. One involves reconstruction of a text from scrambled sentences, and the other looks at changes in sentence order on cloze test performance. The study used one of these approaches, the reconstruction of text, to investigate student ability to reconstitute original sentence orders for each of 6 paragraphs from a science textbook. Subjects were 49 University of Botswana science students; none were first-language speakers of English. Results indicate that students had problems with contrast relationships, sometimes leading to misrepresentation of original meaning. Other anomalies often concerned the order of old and new information. Few problems were found with level of generality. Implications for reading difficulties are examined briefly. A brief bibliography and the texts used, with synopses, are appended. (MSE)

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SENTENCE SEQUENCE AND COHERENCE: IN SEARCH OF READERS' PROBLEMS IN ACADEMIC DISCOURSE

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ABSTRACT

This paper is concerned with two broad issues: the relations between sentence sequence and 'coherence' in written academic discourse, and the identification of likely areas of difficulty for readers. It discusses two approaches to the diagnosis of 'coherence' problems through experimental manipulation of sentence orders in paragraphs or extended text. One of these approaches, involving reconstruction of sentence order by readers, appears promising for further studies of response to discourse. Although extrapolation to normal reading and to writing cannot be taken for granted, relations between predicted reading difficulties and writing problems can also reasonably be anticipated.

Introduction

This paper is concerned with possible identification, through experimental studies, of problems non-native users of English have in achieving 'coherence' in the comprehension and production of written discourse. I shall briefly describe and evaluate two procedures that have been used in a number of studies, including my own research with second-language users of English in Botswana. (Some of the other studies have involved native speakers, and languages other than English). The discussion will focus on reading problems, some of which may admittedly be induced by the nature of the experimental tasks. I believe none the less that one of the approaches to be described, involving reconstruction of sentence order, can prove useful in determining difficulties that actually arise in organising statements and ideas to form coherent discourse and that this will have implications for writing as well as reading with understanding.

The relationship between sentence sequence and coherence has been widely discussed, but I shall confine myself here to two contexts. Hoey (1983, chapter one) has demonstrated that sequential links between sentences are relevant to coherence, but also that coherence involves more than ties between adjacent sentences. He presents a simple technique (devised by E.O. Winter) that can reveal readers' awareness of sequential constraints upon discourse organisation. The readers are presented with sentences in scrambled order and are asked to reconstruct the original text. Typical outcomes of this procedure are claimed to constitute evidence of readers' "instinctive knowledge of discourses" (Hoey, 1983:5). To whatever extent such knowledge may be either "instinctive" or learned, its existence appears to be demonstrated in the completion of the activity. Interestingly, in principle, any gaps in such knowledge might also be revealed, for particular learners or kinds of learner. We shall return to this possibility presently.

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Another approach to the importance of sentence order for discourse coherence arises from empirical studies by Oller and co-workers into effects of changes in sentence order upon cloze test performance (i.e. on ability to supply missing words in a text from linguistic context. See Chihara et al, 1977; Chavez-Oller et al, 1985). These researchers have shown that cloze scores can be significantly reduced when original sentence order is replaced by a scrambled sentence order, particularly for narrative texts. This has implications for what cloze tests measure, indicating that the tests are not sentence-bound (despite Alderson 1979), and also for possible differences in types of text (which we will discuss shortly). Item analyses of cloze tests under the two conditions (original and scrambled sentence order) have been proposed by Chavez-Oller et al as a means of identifying constraints across sentence boundaries that affect cloze responses and may affect discourse comprehension.

Studies that I undertook at the University of Botswana, between 1982 and 1985, and that were subsequently incorporated in my thesis, included work along both these lines of enquiry into reader responses to sentences and discourse coherence. The subjects in the research were students on the Pre-Entry Science Course, a seven-month preparatory course that the university runs for intending degree and diploma students in science and science education.

Each line of enquiry can therefore be evaluated on a basis of experience (which is not to claim the last word). I shall first comment on the approach using cloze tests, and on some assertions about discourse types that have arisen from work in this field. We shall then return to the reconstruction of sentence order, and look at some findings that throw light both on the sequential nature of discourse and on possible problems for readers.

Cloze Tests and Discourse Sequentiality

I shall not attempt here to review in detail the literature on cloze tests, or even that on cloze as a measure of constraints across sentences[1]. In brief, and at the risk of simplification, the following points will be helpful:

1. The findings of Chihara et al (1977) have shown that cloze performance can be affected by constraints across sentences. However, this does not necessarily support claims that cloze is related to "the overall comprehension of a text" (Oller, 1979:346). A modified statement of Alderson's reductionist view of what cloze is measuring (namely, an awareness of local, lexicogrammatical constraints) may well remain tenable.

2. Studies by Shanahan et al (1982) failed to replicate the Chihara et al findings, whereas other studies have succeeded in doing so (Cziko, 1978; Allison, 1986). Chavez-Oller et al (1985), citing Cziko (1983), suggest that one reason for the Shanahan et al findings may have been their choice of 'encyclopedic' descriptive texts, in which information is listed rather than integrated. In a personal communication (1986), Oller, citing Dewey, contrasts narrative and descriptive varieties of text, "the former being highly sequential in its structure and the latter somewhat unstructured". Although his remarks are impressionistic, these are important claims about the nature and variety of sequential coherence in discourses.

There are, however, other views of the nature of (varieties of) descriptive text, involving notions of what van Dijk (1977: 97-98) terms "normal ordering", that also call for attention[2]. One area that will be of particular interest to us concerns the sequence of examples following a general statement.

3. My own work at the University of Botswana successfully extended the Chihara et al findings to two instances of expository text (instructional scientific discourse). However, in further tests, the scrambling of sentence order within individual paragraphs (and that of paragraph order in

longer extracts) was not followed by any noteworthy differences in cloze performance. My conclusion in the thesis was that observed sensitivity of cloze procedure to constraints across sentences reflected more upon aspects of local lexical texture (as well as sentence grammar) than upon overall comprehension of a text. However, it was also possible that the texts I had used lacked sequential coherence for sentences within paragraphs, so that changes made locally in sentence order would not reduce comprehensibility in these instances.

Reader Reconstruction of Sentence Orders

Thus far, my research had proved more revealing with regard to the nature and limitations of cloze procedure, as a possible measure of discourse constraints, than to problems of readers of academic discourse. Another approach to coherence through questions of sentence ordering was attempted, by giving readers the task of reconstructing paragraphs from sentences in scrambled order. The results were of sufficient interest to suggest that the line of enquiry could usefully be pursued further, and also to challenge the view that descriptive paragraphs are (perceived as) sequentially unstructured.

Many language teachers will be familiar with "split story" techniques, in which members of a group are each given a sentence from a story (or news event, etc.) to memorise, after which the group members work together to establish their story. Experience with such activities in English and Study Skills classes at the University of Botswana informally indicated that outcomes sometimes diverged considerably from an original passage, and that students were not convinced by their resolutions of the task. While this could reflect on choice of text, or on the need to achieve group consensus, it provided reason to assume that a sentence unscrambling task given to individual students might prove quite demanding. The high degree of consensus that Hoey reports on such a task with students in the U. K. (presumed to be mainly native speakers of English) would not necessarily be forthcoming in the Botswana context.

The difficulty of a reconstruction task will obviously also vary according to the nature of the connectives used in a text. For example, a list of points introduced by "First", "Second", "Third", and so on, will be unlikely to pose sequencing problems, or to reveal anything of interest. The value of such an exercise will thus depend both upon the relations in a text that need to be understood, and on the nature of the linguistic signalling of these relations. It should not necessarily be assumed, incidentally, that explicit signals of discourse relations will be attended to by readers.

Aims of Study

A study was undertaken to determine how far subjects would be able to reconstitute the original sentence orders for each of six paragraphs from a science textbook (Smith and Cooper, 1979: 197-8). A related question was whether "other" responses would be highly divergent or whether they would converge on a limited number of the possible sequences. An interpretative issue was whether explanations could be advanced for the choices made. The passage chosen had been used, with other students, in some of the cloze studies mentioned earlier, and is reproduced as an appendix to this paper.

In the analysis of findings, particular attention was paid to discourse relations of interest for the research that were present in the text. These were relations of "contrast", "levels of generality" (also including cases in which examples at the same "level" were presented), and "given-new" relations. Other studies (perhaps in different areas of academic writing) could clearly use this procedure for eliciting responses either to these or to other relations.

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Procedure

The study was carried out with 49 subjects (37 male, 12 female) at the University of Botswana. None were first-language speakers of English. These subjects had joined the course as "late entries", following improved O-level results for the country in 1984; they were consequently not a representative sample of the Pre-Entry Science Course intake, and might tend to experience greater comprehension difficulties. (Approximately 65% of these late entry subjects were later recommended for diploma courses and 20% for the degree programme).

The sentences of each paragraphs from the chosen extract had been placed in a scrambled order. (The paragraphs themselves were also placed in a scrambled sequence, which need not concern us here). The relevant task instruction was:

> "In each paragraph below, the sentences (a), (b), etc.have been listed in random order. Can you put them in the right order for the paragraph?"

Answers were written with just the letters denoting the sentences being recorded, and other tasks then followed.

The number of possible sentence orders varied from two, for a paragraph with two sentences, to 720 for a paragraph with six sentences[3]. Obviously, any attempt, in studies such as this, to compare 'number of errors' across paragraphs or texts will have to take account of the different numbers of possible sentence combinations[4].

Results and Discussion

Substantial convergence of responses was found. Choices usually included the original sentence sequence for a paragraph, and a limited number of possible alternatives together with some sequences that I judged to be unacceptable. A full report appears in my thesis. A brief summary of findings and implications now follows.

Problems were found in recognition of contrast relations, with failure in this respect sometimes leading to serious misrepresentations of the original meanings. An example was the placement, by some subjects, of a sentence beginning "This latter energy is the internal energy ..." in a position such that "This" referred anaphorically to external kinetic energy. Other anomalies often concerned the given-new status of information. For example, subjects might arrange sentences in such a way that a term being introduced in a 'nominal definition' had already been in use in their reconstruction of the paragraph.

In contrast to these difficulties, very few problems were found with levels of generality (which are quite often taken as teaching points in courses on academic reading: see, e.g. Discovering Discourse, British Council, 1980, Unit 2). General statements were regularly placed in initial position or occasionally in final position, despite absence of overt connectives to distinguish generalisation from examples. This is not to say that reading problems with levels of generality will not occur, but that their prevalence ought not to be assumed without evidence. The subjects in question had received very little instruction on levels of generality since joining the course.

Interestingly, statements at the same "level of generality", which might have been interpreted by analysts as a listing of examples in arbitrary orders, also proved to have significantly preferred orders. For example, three sentences on behaviour of atoms in substances in different states had a strongly preferred order (solid - liquid - gas), despite the absence of sequence markers; this probably reflects conventional practice. A more surprising example concerned three instances of

work performed against friction (a hammer striking a nail, a chisel ground on an emery wheel, a car tyre on a road surface). Here again, the distribution of responses differed significantly from chance (with amounts of detail and familiarity of content being possible influences). Thus, claims regarding absence of sequentiality in "encyclopedic" descriptive texts (c.f. Cziko, 1983) cannot be taken on trust, as far as reader response is concerned, but would need to be supported by empirical study if they were to be convincing.

Conclusion

As I have suggested, any extrapolation from such studies to actual language use requires caution. In real reading situations, readers follow discourse that has been presented in original sequence. (The extent to which the sequence is essential to the coherence of the discourse may vary according to the text and text type: this question remains open). When writing, a student does not have ready-made sentences to place in an appropriate order. None the less, the paragraph reconstruction technique appears to be a useful research tool for examining the likely incidence of difficulties for particular discourse relations, and under particular conditions of linguistic signalling. A better awareness of our students' difficulties, and of those areas that do not in fact cause severe problems, is clearly a vital element in the planning and implementation of effective language and study support courses.

NOTES

1. See Allison (1986, chapter three) for a fuller review.

2. "Normal ordering", for van Dijk, is a theoretical construct and not an empirical claim about frequency of exponence. None the less, the construct reinforces the view that descriptions, whether of state or process, potentially have structure (however this may be realised in texts): this hardly requires further support here. However, some descriptive writing may still involve lists for which the sequence of items is apparently arbitrary.

3. This figure of 720 sometimes surprises non-statisticians. The number of possible sequences of six sentences is (6 x 5 x 4 x 3 x 2 x 1).

4. For possible error criteria, see Hoey (1983:4). Although Hoey's criteria are insufficient to ensure coherence, responses that violate the criteria will often reveal difficulties in understanding and organisation of statements and ideas

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APPENDIX

Paragraphs used in the reconstruction study are shown below in their original order. The extract, from Smith and Cooper (1979), is part of a longer section on 'Heat and Internal Energy' and is not fully self-contained. Paragraph numbers are added for ease of reference. A synopsis follows the extract.

I. The basic particles of all matter are in constant motion. Atoms in solids vibrate back and forth in complex motions about their equilibrium positions. Molecules in a liquid wander around among the other molecules, having frequent collisions with them and thus exchanging energy. In gases molecules travel about at high speeds and have frequent elastic collisions with their neighbors. The sum of the kinetic and potential energies associated with the random motion of the atoms of a substance is the internal energy of the substance.

II. Consider a bullet flying through the air with velocity v. This bullet has a kinetic energy $1/2\ mv^2$ associated with the speed of its center of mass. In addition to the kinetic energy due to the organized, collective motion of the atoms of the bullet there is also energy associated with the random motion of the atoms relative to the center of mass. This latter energy is the internal energy; it depends on the temperature of the bullet and is independent of the external kinetic energy $1/2\ mv^2$. The internal energy is there even when the bullet is at rest. If the moving bullet strikes a block of wood, much of the external energy $1/2\ mv^2$ is converted into internal energy and the temperature of the bullet rises substantially.

III. When we heat a material, its internal energy is increased. The nature of the heating process was speculated upon and argued over for centuries before the answer began to evolve at the end of the eighteenth century. One idea which held wide support for many years was that a fluid called caloric entered a body when it was heated and leaked away as the body cooled. When measurements of the mass of a body showed no increase when the body was heated, the proponents of the caloric theory argued that the fluid was massless. As a rival of the caloric theory, there gradually evolved the modern point of view that heat is a form of energy. More specifically: heat is energy which is transferred between a substance and its surroundings or between one part of the substance and another as a result of temperature differences only.

IV. One of the decisive experiments supporting the theory that heat is a form of energy was performed by Count Rumford in 1798, where he observed that boring cannon resulted in a large increase in temperature although there was no flame or other source of caloric. When the drill was dull, the rise in temperature was exceedingly great and was related to the amount of mechanical work done in the drilling. Thus, adding energy to the cannon by doing work against friction led to the same temperature response as heating it in a furnace.

V. When we pound a nail with a hammer, the nail becomes hot. As the hammer is stopped, the atoms in the nail are given energy which shows up in the form of increased internal energy. After the hammer has struck, the atoms vibrate with greater amplitudes about their equilibrium positions. When a chisel is ground on an emery wheel, its thermal energy and its temperature are increased. When a moving automobile is stopped, its kinetic energy is transferred to internal energy in the brake drums, tires, and road. In all such cases work is done against friction with a resulting increase in the internal energy of the bodies involved.

VI. We can increase the internal energy of a substance either by adding heat to it or by performing work on it in such a way as to increase the random motion of the atoms. We can raise the temperature of the air in a bicycle pump either by heating the barrel of the pump in a flame or by doing work on the gas by vigorous pumping.

SYNOPSIS

Paragraph I. (Five sentences). Defines "internal energy". Nominal definition, preceded by description.
(Presents the constant motion of particles. Exemplifies, for the three states of a substance. Introduces "internal energy").

Paragraph II. (Six sentences). Distinguishes internal energy (presumed new) from external kinetic energy (presumed known). Comparison: contrast.
(Recalls kinetic energy of a moving object. Distinguishes this from random motion of atoms. Notes possibility of converting external into internal energy).

Paragraph III. (Six sentences). Presents internal energy as solution to problem of nature of heat. A problem and two contrasted solutions.
(Relates heat and internal energy. Outlines historical discussion of problem of nature of heat. Contrasts two theories; shows that one has been rejected, while other is currently accepted. Gives modern definition of heat).

Paragraph IV. (Three sentences). Presents evidence for solution.
(Presents experimental evidence, against "caloric" theory and consistent with "energy" account of heat. States conclusion that temperature can be increased by doing work against friction).

Paragraph V. (Six sentences). Further exemplification of conclusion.
(Cites some familiar instances of mechanical work leading to increase in temperature. States general conclusion).

Paragraph VI. (Two sentences). Summarises conclusions.
(Indicates that one can increase internal energy in either of two ways: apply heat source; perform work against friction. Exemplifies).

(The passage goes on to consider 'temperature', in the light of the above).

The sequence of topics and paragraphs derives in part from wider development in the chapter, and from anticipated reader knowledge of the topic. The paragraph order is not the sole "logical" order that might be dictated by content. There is considerable anticipation and restatement of conclusions in the passage.